Physical & Applied Sci.

The TECHNOLOGY MONTHLY

And

LIBRARY
JUL 7 1938
OF TECHNOLOGY

HARVARD ENGINEERING JOURNAL

April 1916 Vol. III, No. 1

The Massachusetts Institute of Technology

BOSTON, MASS.

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY aims to give thorough instruction in *Civil, Mechanical, Chemical, Mining, Electrical,* and *Sanitary Engineering;* in *Chemistry, Electrochemistry, Architecture, Physics, Biology* and *Public Health, Geology, Naval Architecture;* and in *Engineering Administration.*

To be admitted to the Institute, the applicant must have attained the age of seventeen years and must pass examinations in algebra, plane and solid geometry, physics, history of the United States (or Ancient History), English, French and German. Preparation in two of a series of elective subjects is also required. A division of these examinations between different examination periods is allowed. In general, a faithful student who has passed creditably through a good high school, having two years' study of French and German, should be able to pass the Institute examinations.

Graduates of colleges, and in general applicants presenting certificates representing at least a year of satisfactory work at another college, are excused from the usual entrance examinations and from any subjects already satisfactorily completed. Records of the College Entrance Examination Board, which holds examinations at many points throughout the country and in Europe are also accepted for admission to the Institute.

Instruction is given by means of lectures and recitations, in connection with appropriate work in the laboratory, drawing-room or field. To this end extensive laboratories of chemistry, physics, biology, mining, mechanical engineering, applied mechanics, and the mechanic arts, have been thoroughly equipped, and unusual opportunities for field-work and for the examination of existing structures and industries have been secured. So far as is practicable, instruction is given personally to small sections rather than by lectures to large bodies of students.

The regular courses are of four years' duration, and lead to the degree of Bachelor of Science. In most courses the work may also be distributed over five years by students who prefer to do so. Special students are admitted to work for which they are qualified; and the degrees of Master of Science, Doctor of Philosophy, and Doctor of Engineering are given for resident study subsequent to graduation. Opportunity for research is offered in all the departmental laboratories, in the three recently established Research Laboratories of Applied Chemistry and Physical Chemistry, and in the Sanitary Research Laboratory and Sewage Experiment Station.

The tuition fee, not including breakage in the laboratories, is $250 a year. In addition, $30 to $35 per year is required for books and drawing materials.

For catalogues and information, address

Professor ALLYNE L. MERRILL, *Secretary of the Faculty,*

491 Boylston Street, Boston

Physical &
Applied Sci.
Serials

Physical &
Applied Sci.

PREPARE FOR THE INSTITUTE

At CHAUNCY HALL SCHOOL 553 Boylston Street, Copley Square

The only school confining itself wholly to preparing men for the Institute of Technology

ADVANTAGES:

New quarters, newly furnished, near the Institute.
Chemical and Physical Laboratories equipped with the best of apparatus.
Teachers who are specialists in their several departments.
The number of students in classes is limited, that all may get the most thorough instruction.
Our candidates not only pass their entrance examinations, but maintain high standing at the Institute

Tech men are invited to inspect the school, or to write for particulars. FRANKLIN T. KURT, Principal

4 THINGS

are assured by your early order

No. 1 Security against advanced prices in clothes — an advance in a short time as sure as you live.

No. 2 Procuring foreign dyed woolens — **by looking ahead** — we can offer an entire and large stock of such woolens.

No. 3 Better workmanship before the "rush reason" is on.

No. 4 A larger stock from which to make your choice.

BURKE & CO., Inc., Tailors

1256 Massachusetts Avenue (Harvard Square), Cambridge
18 School Street, Boston

The Berkeley Preparatory School

Preparation for Mass. Institute of Technology

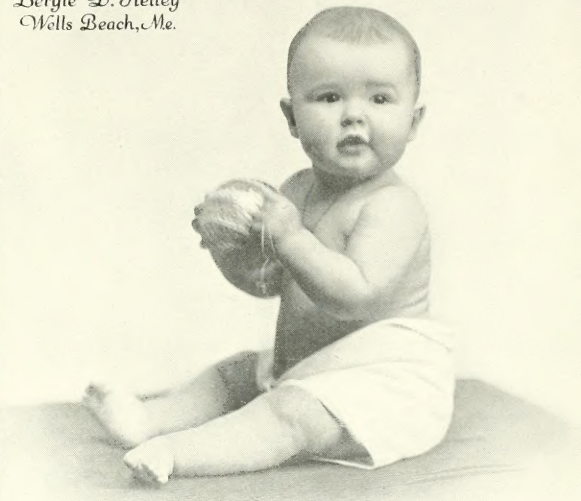
Any Scientific School

References Given Tuition $180.00 per year

62-64 St. James Avenue, Boston, Mass.
Henry Hopkinson, Principal

"We are advertised by our loving friends"

Beryle D. Kelley
Wells Beach, Me.



A Mellin's Food Boy

His rugged body and splendid development are the result of the

Mellin's Food Method of Milk Modification

Write today for our instructive book, "The Care and Feeding of Infants"

Mellin's Food Company, Boston, Mass.

The Technology Monthly
and Harvard Engineering Journal

A magazine devoted to the interests of the Massachusetts Institute of Technology—The Official Organ of the Association of Harvard Engineers

Vol. III — Contents, April, 1916 — No. 1

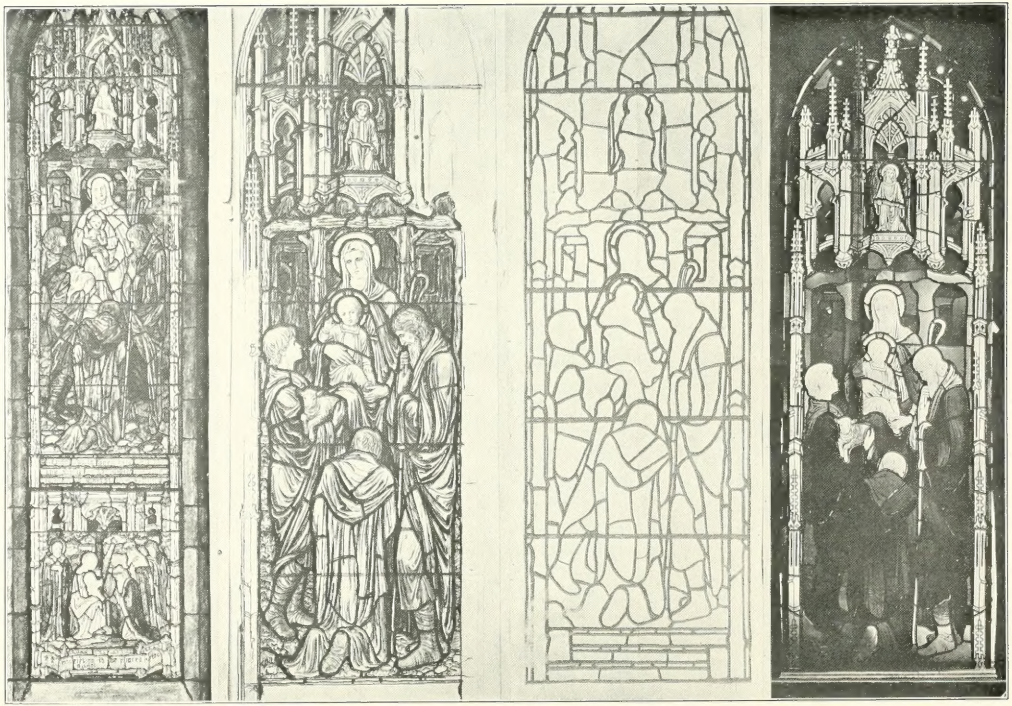
STAINED GLASS WINDOWS IN PROCESS OF MAKING		Frontispiece
STAINED GLASS WINDOWS: THE CRAFT Illustrated	Charles J. Connick	5
THE WIND TUNNEL OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY	J. C. Hunsaker, U. S. N., S. M.	9
THE INSTITUTE AND THE HONOR SYSTEM	Richard H. Catlett, M. I. T., '17	14
THE MID-YEAR TRIP OF THE ELECTRICAL ENGINEERING SOCIETY Illustrated	A. Edward Tuttle, M. I. T., '17	18
HOW UNDERGRADUATES CAN HELP AT THE DEDICATION	John Ritchie, Jr.	23
THE TECH METHOD OF TEACHING—THREE REPLIES	Edwin T. Cole, U. S. A. Eastman A. Weaver, M. I. T., '15 An Undergraduate	26 28 29
ENTROPY OF CIVILIZATION	Henry F. Goldsmith, M. I. T., '17	33
EDITORIAL Comments True Technology Preparedness Any One of a Dozen Ways		36
HARVARD GRADUATE NOTES		39
HARVARD ENGINEERING SOCIETY OF NEW YORK		40
LOCAL COLOR	Carl J. Heath, M. I. T., '17	41
CARTOONS		
"Reminiscences—That's All—"	L. F. van Zelm, M. I. T., '18	42
NO—Tech Doesn't Need a New Gym	"	45
New York vs. Boston	"	46
"Impressions"	The New Cartoonist	51

Copyright, 1916, by The Technology Monthly

Entered as second-class matter at the post office, at Boston, Mass. Published monthly during the college year by the students of the Massachusetts Institute of Technology. Publication office, Technology Union Building, 42 Trinity Place, Boston. Harvard Editorial Office, 218 Pierce Building, Cambridge, Mass.

Mail Address: Technology Monthly, M. I. T., Boston, Mass.
Phone Back Bay 58494

Subscription rate, $1.50 per year; 25c. per copy. Advertising rates upon application



Stained Glass Windows, The Craft

A. B. C. D.

THE TECHNOLOGY MONTHLY
AND HARVARD ENGINEERING JOURNAL

VOL. III BOSTON, MASS., APRIL, 1916 NO. 1

STAINED GLASS WINDOWS: THE CRAFT

By CHARLES J. CONNICK

Editor's Note. There are few crafts still existing in which the true spirit of the artist—"art for art's sake"—has not been displaced by commercialism. Stained glass is one of these, and for this reason alone is of especial interest.

The destruction of so many world-famous stained glass windows in the present European War should make every American proud of the fact that we have craftsmen of Mr. Connick's type on this side of the Atlantic.

EVERY artist, whatever his chosen medium, must approach his work with something of the spirit of the craftsman. He must deal with the fundamental facts of his materials honestly, and build substantially, alone or with the help of others. He must be inspired by the possibilities of the medium, yet aware always of its limitations.

Probably no medium appeals so strongly to the lover of pure color as does that known as stained glass; but no other medium is more exacting in its demands for sound knowledge and sincere craftsmanship on the part of the artist and his fellow-workers.

The artist in glass cannot work alone, unless he have unlimited time and other provisions which make for absolute economical and social independence. His palette weighs tons, and demands many square feet of floor space. He must have great benches instead of canvas stretchers, a huge kiln instead of a spirit lamp, hundred-weights of lead, pounds of solder, and quantities of vitrifiable paint before he is ready to consider the building of a single window. And even then he can do nothing without that precious element, light. He must have floods of it, if his windows are to stand the test sure to be given them in their actual positions in churches, or residences.

The processes involved in making a stained-glass window are doubtless very similar, essentially, to those employed by the master craftsmen seven hundred years ago, when the treasures of Reims, Chartres and Bourges were wrought into enduring form. First, the design is drawn and colored. (Illustration A). It is usually in water-color, "to scale," and is carefully studied, with its lead-lines, bar-lines, ventilators, etc. Of course the first consideration has to do with the color scheme, and its decorative value as a composition in leaded glass, in relation to the architecture of the building in which it is to be placed. Always, it must be remembered: "This medium is the handmaid of architecture, and can only justify itself by loyal service to its mistress. The ideal of the stained-glass artist must not be a picture made transparent, but a window made beautiful."*

* Hugo Arnold

Illustration G. The Finished Window

When the design has been approved by the architect and the client, the cartoon is drawn. (Illus. B). It is in charcoal usually, and is the glass man's full-sized drawing. Every detail in lead and paint is carefully considered, and all bar-lines are shown. Bars are usually of half-inch round iron. They are fastened to the finished window by means of wires soldered to the leads, and while adding greatly to the stability of the window, are also essential parts of every window design.

From the cartoon the working drawing and patterns are made. (Illus. C). The patterns are cut out of heavy paper with a double-bladed knife (or double scissors), which takes out an allowance for the heart of the lead. The leads are H shaped, and the centre bar of the H may be considered the heart of the lead.

With the design for a guide in color, and the working drawing and patterns for definite shapes, the glass is picked out and cut. By means of wax the pieces are held together on a large pane of plate glass, and essential changes are made. Heavy lines are painted on the back of the plate glass to approximate lead-lines, and important lines are traced on the glass in paint from the cartoon. (Illus. D). A flat mat of paint is deftly floated and blended over these traced lines, and definite detail is obtained in flat decorative masses by taking out lights with stiff brushes—a reversal of the process associated with opaque surfaces.

The paint so employed is warm neutral or black in color, is composed largely of iron and flux, and is fused into the glass by means of the very high temperature to which it is subjected in a kiln provided for the purpose. (Illus. E). This reduces the opaque value of the painted surface about fifty per cent, but does not (except in rare instances)

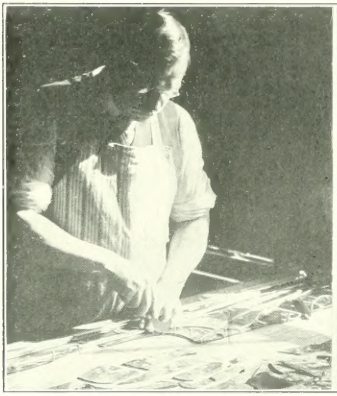


Illustration F. Assemblying

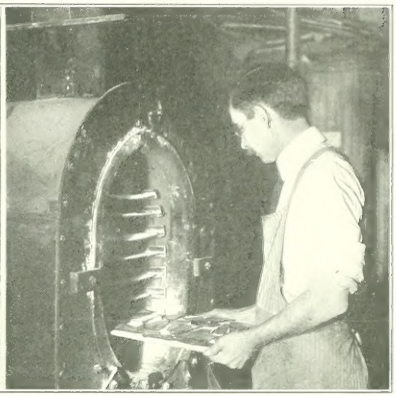


Illustration E. Firing

change the color of the glass itself. In this connection, it is important to note that paint is used, not to dim the lustre of the glass in light, but to give a texture and a play of light through the colored glass—as it is influenced by spots of paint, lead-lines, and bar-lines. For a most accurate study of this phase of the present subject see "Vitrail," by Viollet le Duc.

When the glass is removed from the kiln, the pieces are re-assembled and again placed upon the sheet of plate glass which serves for an easel, and once more fastened with molten wax. It is then repainted, and those parts requiring it are stained, and the glass is once more subjected to high temperature in the kiln. Each piece is carefully examined as it is taken from the kiln, and if the paint has not been thoroughly fused into the glass, a third firing is necessary. Ordinarily, however, one long, steady firing is quite sufficient to provide for the permanence of this color; but two or more firings admit of no question, and provide the opportunity just mentioned for strengthening and retouching painted lines and tones.

Mention was made of the fact that stain is applied to the glass usually just before the second firing. It should be explained that this stain provides the one transparent color—a true yellow of varying intensity—which the artist in glass can depend upon, in addition to the palette of colored glass before mentioned. The stain is composed of silver salts, and was at times so popular with glassmen and patrons alike, that the term "stained glass" was thought to have originated from its use. Some authorities hold, however, that this usage originated, not from the employment of silver stain, but from the fact that colored glass was "stained" in the pot through the use of various mediums.

When it has been determined that the paint is thoroughly fused into the glass, it is placed piece by piece upon the working drawing, just as one would put together a picture-puzzle, and the glazier begins his task of wrapping the pliant leads, of different weights and thick-

nesses, about the pieces of glass, and forcing them into their places in the design. (Illus. F). Without light it has become an almost meaningless "map-puzzle" lying upon his bench, and his intelligent sympathy with the artist whose design and cartoon are also before him, is indispensable to his task.

The joints of the lead are soldered on both sides, but the whole structure is very flimsy until every slightest crevice between the leaf of the lead and the glass has been filled with a special, hard, resilient, waterproof cement. (Illus. G.)

Everyone is eager to see the finished window for the first time. It often has surprises to offer. Many of them are joyous ones, for no expedient can quite approximate the lustrous blacks of the leads in their relation to the color of the glass with the pigment well fused into it. Then, too, the stain, where it has been used for a bit of enrichment in the canopy or on white draperies, has not been seen before—except as a muddy smudge.

He is surely a most blase "glass man" who is not thrilled at the first glimpse of his work, completed with the help of many well-taught, talented hands and sympathetic minds. For he must realize that, without the bond of friendliness between him and them, and without a sincere love for the craft and its possibilities on the part of all, a smug and complacent commercialism would enter into these processes, and all real joy in them would inevitably be lost.

It is easy to understand why so many studios and workshops are tainted with commercialism. Every process presents an avenue for its entrance. Every competition has a tendency to encourage it, through placing premiums upon hurried and careless efforts, and upon countless little tricks and subterfuges with which every careful student of the craft may be familiar.

Certainly no one of the artistic crafts is more rigorous in its demands upon the artist than is that of stained glass; for he who makes the water-color design should be absolute master of all the processes that follow. He should express himself as surely through one operation as through another, though heads and hands be called, through sheer necessity, to aid him. Co-operation is peculiarly an essential requirement of this craft, which fact surely detracts nothing from its fair name.

This paper has been a more or less dull and dry statement of "ways how," but the real glory and fascination of this artistic craft cannot be written down save by the most gifted poet. His eloquent expression could only faintly suggest the vibrant splendor of glass in pure color as it is seen in the ever-changing light of day. No words could carry the emotional thrill, the uplift, the charm (so akin to that felt in music) which are constantly encountered by "glass-men" in their daily routine. Therefore, it will be hard to find a sincere artist in glass who is not a flaming enthusiast in his love for the craft.

THE WIND TUNNEL OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

By J. S. HUNSAKER, U.S.N., S.M.
Assistant Naval Constructor, United States Navy, Instructor in Aerodynamics, M.I.T.

Editor's Note. The reasoning for the development of experimental apparatus for technical research cannot help but be of interest to you, whether in this field or another. By processes of reasoning such as shown in this article depends your future success. In the January, 1915, issue of *The Technology Monthly and Harvard Engineering Journal* the construction of the Aerodynamical Laboratory was described. A description of its workings follows. This article is reprinted from Smithsonian Miscellaneous Collections, Vol. 62, No. 4.

AN aeroplane or airship in flight has six degrees of freedom, three of translation and three of rotation, and any study of its behavior must be based on the determination of three forces—vertical, transverse and longitudinal—as well as couples about the three axes in space. Full scale experiments to investigate the aerodynamical characteristics of a proposed design naturally become difficult to arrange. The experimental work is much simplified if tests be made on small models as in naval architecture, and a further simplification is made by holding the model stationary in an artificial current of air instead of towing the model at high speed through still air to simulate actual flying conditions.

The use of a wind tunnel depends on the assumption that it is immaterial whether the model be moved through still air or held stationary in a current of air of the same velocity. The principle of relative velocity is fundamental, and the experimental discrepancies between the results of tests conducted by the two methods may be ascribed, on the one hand, to the effect of the moving carriage on the flow of air about the model and to the effect of gusty air, and on the other hand to unsteadiness of flow in some wind tunnels.

The wind tunnel method requires primarily a current of air which is steady in velocity both in time and across a section of the tunnel. The production of a steady flow of air at high velocity is a delicate problem, and can only be obtained by a long process of experimentation. A study was made of the principal aerodynamical laboratories of Europe from which these conclusions were reached: (1) That the wind tunnel method permits a leisurely study of the forces and couples produced by the wind on a model; (2) that the staff of the National Physical Laboratory, Teddington, England, have developed a wind tunnel of remarkable steadiness of flow and an aerodynamical balance well adapted to measure with precision the forces and couples on a model in any position; and (3) that the results of model tests made at the above laboratory are applicable to full scale aircraft.

Consequently it was decided to reproduce in Boston the best features of the tunnel of the National Physical Laboratory, together with the new type of balance and instrument for visual measurement. Dr. R. T. Glazebrook, F. R. S., director of the National Physical Laboratory, most generously presented us with detailed plans of the

plete illustration, including the pattern from which the aerodynamical balance was made. Due to this encouragement and assistance we have been able to set up an aerodynamical laboratory with confidence in obtaining a steady flow of air of known velocity. The time saved us by Dr. Glazebrook, which must have been spent in original development, is difficult to estimate.

The staff of the National Physical Laboratory have developed several forms of wind channels as affected by the design both of the channel and the building by which it is enclosed. The conclusions reached may be summarized as follows:

(1). The suction side of a fan is fairly free from turbulence.

(2). A fan made by a low pitch four-bladed propeller gives a steadier flow than the ordinary propeller fan used in ventilation, and a much steadier flow than fans of the Sirocco or centrifugal type.

(3). A wind tunnel should be completely housed to avoid the effect of outside wind gusts.

(4). Air from the propeller should be discharged into a large perforated box or diffuser to damp out the turbulent wake and return the air at low velocity to the room.

(5). The room through which air is returned from the diffuser to the suction end of the tunnel should be at least 20 times the sectional area of the tunnel.

(6). The room should be clear of large objects.

The wind tunnel of the Massachusetts Institute of Technology was built in accordance with the English plans, with the exception of several changes of an engineering nature introduced with a view to a more economical use of power and an increase of the maximum wind speed from 34 to 40 miles per hour.

Upon completion of the tunnel an investigation of the steadiness of flow and the precision of measurements was made in which it appeared that the equipment had lost none of its excellence in its reproduction in the United States.

As will be shown below, the current is steady both in time and across a cross-section within about 1 per cent in velocity. Measurements of velocity by means of the calibrated Pitot tube presented by the National Physical Laboratory are precise to one-half of 1 per cent for ordinary magnitudes. Calculated co-efficients which involve several measurements of force, moment, velocity, angle, area, and distance, as well as one or more assumptions, can be considered as precise to within 2 per cent. It is believed that it is not practicable to increase the precision of the observations to such an extent that the possible cumulative error shall be materially less than the above.

DESCRIPTION OF WIND TUNNEL

A shed 20 by 25 by 66 feet houses the wind tunnel proper, 16 square feet in section, and some 53 feet in length. Air is drawn through an entrance nozzle and though the square tunnel by a four blade propeller, driven by a 10 H. P. motor. Models under test are mounted in the center of the square trunk on the vertical arm of the balance to be described later.

The air entering the mouth passes through a honeycomb made up of a nest of 3-inch metal conduit pipes 2 feet 6 inches in length. This honeycomb has an important effect in straightening the flow and preventing swirl.

Passing through the square trunk and past the model, the air is drawn past a star-shaped longitudinal baffle into an expanding cone. In this the plans of the National Physical Laboratory were de-

parted from by expanding in a length of 11 feet to a cylinder of 7 feet diameter. This cone expands to 6 feet in the English tunnel. M. Eiffel affirms that the working of a fan is much improved by expanding the suction pipe in such a manner as to reduce the velocity and so raise the static pressure of the air. Since the fan must discharge into the room, the pressure difference that the fan must maintain is thus reduced. Also with a larger fan the velocity of discharge is reduced, and the turbulence of the wake kept down.

The propeller works in a sheetmetal cylinder 7 feet in diameter, and discharges into the large perforated diffuser. The panels of the latter are gratings and may be interchanged fore and aft. The gratings are made 1½ by 1½ inches. Each hole is then a square nozzle one diameter long. The end from the propeller is stopped by this wall and the air forced out through the holes of the diffuser. Its velocity is then turned through 90 degrees. The area of the diffuser holes is several times the sectional area of the tunnel, and the holes are so distributed that the outflow of air is fairly uniform and of low velocity.

A four-bladed black walnut propeller of the Drzwiecki system was designed and has proved very satisfactory. In order to keep down turbulence a very low pitch propeller with broad blades must be made thin. It then became of considerable difficulty to insure proper strength for 900 R.P.M. as well as freedom from oscillation.

The blade sections were considered as model aeroplane wings and their effect integrated graphically over the blade. The blade was given an angle of incidence of 3 degrees to the relative wind at every point for 600 R.P.M. and 25 miles per hour. The pitch is thus variable radially.

To prevent torsional oscillations, the blade sections were arranged so that the centers of pressure all lie on a straight line, drawn radically on the face of the blade. This artifice seems to have prevented the howling at high speeds commonly found with thin blades. The propeller has a clearance of ½ inch in the metal cylinder.

The propeller is driven by a "silent" chain from a 10 H.P. inter-pole motor beneath it. The propeller and motor are mounted on a bracket fixed to a concrete block and are independent of the alignment of the tunnel. Vibration of the motor and propeller cannot be transmitted to the tunnel as there is no connection.

The English plans for power contemplate a steady, direct current voltage. Such is not available here. A 15 H.P. induction motor is connected to the mains of the Cambridge Electric Light Company. This motor then turns at a speed proportional to the frequency of the supply current for a given load. Fluctuations of voltage are without sensible effect, and the frequency may be taken as practically constant.

The induction motor is directly connected to a 12 H. P. direct current generator, which is turned at constant speed and which generates, therefore, a constant direct current voltage for given load.

By change of the generator field rheostat and motor field rheostat the propeller speed can be regulated to hold any wind velocity from 4 to 40 miles per hour. The control is very sensitive. Left to itself, the speed of the wind in the tunnel will vary by 2 per cent in 2 or 3 minutes. This variation is so slow that by manipulation of the rheostats the flow can be kept constant within 1 per cent. The cause of the surging of the air is not understood, but is probably due

to hunting of the governor of the prime mover in the Cambridge power house causing changes in frequency too small to be apparent. The gustiness of outdoor winds seems to have no effect, although the building is not air-tight.

AERODYNAMICAL BALANCE

The Aerodynamical balance was constructed by the Cambridge Scientific Instrument Company, England, to the plans and patterns of the National Physical Laboratory. In general, the balance consists of three arms mutually at right angles representing the axes of co-ordinates in space about and along which couples and forces are to be measured. The model is mounted on the upper end of the vertical arm which projects through an oil seal in the bottom of the tunnel.

The entire balance rests on a steel point, bearing in a steel cone. The point is supported on a cast-iron standard secured to a concrete pillar, which in turn rests on a large concrete slab. The balance is then quite free from vibration of the floor, building, or tunnel.

The balance is normally free to rock about its pivot, in any direction. When wind blows against the model, the components of the force exerted are measured by determining what weights must be hung on the two horizontal arms to hold the model in position. Likewise the balance is free to rotate about a vertical axis through the pivot. The moment producing this rotation is balanced by a calibrated wire with graduated torsion head.

Force in the vertical axis is measured by means of a fourth arm. The model for this measurement is mounted on the vertical rod which slides freely on rollers inside the main vertical arm of the balance. The lower end of this rod rests on one end of a horizontal arm having a knife edge and sliding weight.

For special work on moments, the interior vertical rod is replaced by another having a small bell crank device on its head which converts a moment about the center of the model into a vertical force to be measured as above.

In this way provision is made for the precise measurement of the three forces and the three couples which the wind may impress on any model held in any unsymmetrical position to the wind.

The balance is fitted with suitable oil dash pots to damp oscillations, and devices for limiting the degrees of freedom to simplify tests in which only one or two quantities are to be measured. The balance can be adjusted to tilt for 1/10,000 pound force on the model. In general, the precision of measurements is not so good as the sensitivity, and in the end is limited by the steadiness of the wind and the skill of the observer.

The weights and dimensions of the balance were verified by the National Physical Laboratory, where also the torsion wires were calibrated.

For ordinary forces, weighings may be considered correct to 0.5 per cent. Naturally for very small forces, such as the rolling moment caused by a small angle of yaw, the measurements cannot be so precise.

ALIGNMENT OF TUNNEL

The axis of the wind tunnel was desired to be horizontal from the honeycomb to the baffle plates in front of the propeller. To accomplish this an engineer's level was mounted on a platform, built on the floor of the house, opposite the mouth of the tunnel, and sighted on the intersection of diagonal threads placed at 6-foot intervals. By this means the distance of the center line of the tunnel above or below the horizontal line could be estimated to one-eighth of 1 inch.

The tunnel being low in the center, it was raised by wedges until the reference marks coincided with the horizontal This was attained to within one-eighth of 1 inch in 6 feet of tunnel length. The tunnel may, therefore, be said to have its axis horizontal to within one-tenth degree.

ALIGNMENT OF VERTICAL AXES OF BALANCE

A concrete foundation having been built for the balance, the latter was set in its approximate position. Three wedges were then inserted under the base plate of the balance standard, and the whole balance raised to its proper height. It was now necessary to rectify the vertical axis of the balance.

To bring the axis of the balance more nearly vertical by more sensitive means the following method was employed: The small torsion wire, used in aerodynamical measurements with the balance, was set in place. The lower pivot of the balance was engaged in its bearing, leaving the balance free to rotate about its vertical axis, but constrained from tipping laterally.

The torsion wire was adjusted by means of the micrometer head until the cross-hair on the fixed telescope coincided with that on the mirror attached to the balance proper.

A weight of 0.4 pound was placed on one balance arm. The micrometer head was again turned until the cross hairs were coincident. By setting up on the holding-down bolts, the balance axis was adjusted until placing a weight on either of the arms required no further rotation of the torsion head to maintain coincidence of the cross-hairs. In such case the axis of the balance is vertical. The final adjustment admits of a possible error of less than 1 400 inch-pound on the torsion wire. The angularity of the balance axis remaining uncorrected may be computed as follows:

Let F = force hung on arm.

B = angle of balance axis to vertical.

Then, taking moments about the vertical axis

$$F \sin B \times 18'' = 0.4 \cdot \sin B \times 18'' = 1\ 400$$

or $B = 0.025$.

(To be concluded)

THE INSTITUTE AND THE HONOR SYSTEM

By RICHARD H. CATLETT, M.I.T., '17
B.A. University of Virginia, '14

Editor's Note. The editor grew up near Princeton, where the Honor System has been found to work very successfully. One of the shocks of his Freshman year was our present system of conducting examinations. He thought that of course the Honor System was in use at Technology.

We believe that it should be put into effect here, among the upper-class men at least. It appears to us as a most excellent means of developing manhood You will probably be asked to vote on it. What do *you* think of it?

THAT the honor system when properly supported is the ideal form of school and college government, is the unqualified opinion of every right thinking man. At this time, when the establishment of the honor system at Tech is being agitated for the first time, we hear no question as to the desirability of the system, but we do hear very widely expressed the opinion that it could not be successfully enforced here. Undoubtedly we shall be called upon sooner or later to decide this question, and when the time comes we must have a very clear understanding of the workings of the system, and the obligations which it entails.

The honor system was first established at the University of Virginia in 1842, and since that time it has been adopted by many other colleges and universities (to a total of 123), such as Princeton, Cornell, Lehigh, Carnegie Institute, University of Pennsylvania, University of Michigan, etc. The systems at Virginia and Princeton are looked upon as models and it is to these two, alike in principle and ideals, and differing only in those minor details imposed by environment, that we naturally turn our attention. I shall deal with the practical workings of the honor system at the University of Virginia, with such references to its origin and history as I consider necessary to the understanding of its aims and ideals.

In the report to the legislature of the commission appointed to fix the site and draw up plans for the University of Virginia, Jefferson wrote.

"The best mode of government for youth in large collections is certainly a desideratum not yet attained by us. It may be well questioned whether *fear* after a certain age is a motive to which we should have ordinary recourse. The human character is susceptible of other incitements to correct conduct more worthy of employ and of better effect. Pride of character, laudable ambition, and moral dispositions are innate correctives of the indiscretions of that lively age; and, when strengthened by habitual appeals and exercise, have a happier effect on future character than the degrading motive of fear. Hardening them to disgrace, to capital punishment and servile humiliations cannot be the best process for producing erect character. The affectionate deportment between father and son offers in fact the best example for that of tutor and pupil; and the experience and practice of other countries in this respect may be worthy

of inquiry and consideration with us. It will then be for the wisdom and discretion of the visitors to devise and perfect a proper system of government, which if founded in reason and comity will be more likely to nourish in the minds of our youth the combined spirit of order and self-respect, so congenial with our political institutions and so important to be woven into the American character."

This expression by Jefferson is regarded as the true "germ and axiom" of the honor system at Virginia. So radical, however, was the suggestion of Jefferson, compared with the old standard of the Virginia fathers, that the honor system did not have its beginnings with the opening of the university. It was not until seventeen years later that the first step was made by the passage in faculty meeting of the following resolution.

"Resolved, that in all future written examinations for distinction and other honors of the university, each candidate shall attach to the written answers presented by him, on such examination, a certificate in the following words: 'I, A. B., do hereby certify on honor that I have derived no assistance during the time of this examination from any source whatever, whether oral, written, or in print, in giving the above answers.'"

The form of the pledge was afterwards changed to include not only the receiving but also the giving of assistance. In essence the same pledge is used at the present time, having been shortened, however to read as follows: "I hereby pledge my word of honor that I have neither given nor received assistance on this examination."

Any violation of the pledge is punished by instant dismissal of the offending party from the university. The whole treatment of breaches of the honor system is handled by the honor committee, composed of the [illegible] the various departments of the university and the vice-president of the department of the [illegible]

One feature of the [illegible] frequently questioned and criticised by outsiders is the unwritten understanding that any student who observes a breach of honor must immediately take action to have the offender brought to justice. The procedure usually followed is the private interviewing of the suspect, in which he is asked to explain his actions, and in case of unsatisfactory explanation advised to make his departure as quietly and as quickly as possible. In case he refuses he is reported to a member of the honor committee, and the advice is repeated with invariably prompt results.

The criticism of this is that it countenances and encourages tale-bearing. At first sight this may seem a just objection but looked at in the light of a thorough knowledge of conditions it is readily understood and approved. The condition is analogous to many cases in civil life. Who would fail to report the thief or the incendiary or the murderer, when caught in his act of crime? No man would consider himself a good citizen who allowed such a man to remain at large. He is a menace to the community, and as such is turned over to the nearest police officer for imprisonment. In the same way the student at the University of Virginia looks upon him who violates the principles of the honor system. The honor system is the most precious possession of the [illegible] lives, and he would feel himself a traitor should he allow its violator to remain, a constant source of danger, and a breeder of weakness, in its midst.

There are [illegible] the examination room during the time of the examination. The professor is usu-

ally present for the first half hour of the period to answer inquiries as to the interpretation of the examination questions. He then leaves the room, and the students are free to come and go as they please. In case a student while taking an examination desires to go to his room or any other remote point he usually asks a friend to accompany him in order that he may avoid the possibility of suspicion, but this is not considered necessary.

The honor system, originally applied to the taking of examinations alone, has spread in its application until it applies to all phases of student life, and deals with dishonesty, not only in the class room and examination room, but in student relations wherever they exist, and whatever their nature. The student who cheats at cards or gives bogus checks is just as much liable to dismissal by the honor committee as he who uses an unauthorized text book in taking an examination.

What it is that makes this condition impossible of immediate attainment at Tech? We shall certainly not go far for reasons. The University of Virginia is a community to itself. Students, professors, and officials live in close contact with one another and the dominating spirit of the institution cannot fail to be transmitted early in his career to each newcomer to this community. Tech is entirely different. After recitation hours the students are scattered over the whole city of Boston and all the outlying towns and cities. There can be no intimacy among the students as a whole. There can be no *esprit de corps* to guide or restrain the individuals. Each man *is* an individual, and not a part of an organization. As an individual he is free to choose his course as best suits his nature and his desires.

Another difficulty encountered at Tech is the lack of sympathy between the students. Here we have men of every nationality, every creed, and every condition. The close understanding and firm co-operation of such a body is unimaginable. Seventeen languages, twenty religions and sects—a structure of their building would indeed be a Tower of Babel.

But why should we cast aside all thought of bettering conditions, because very obviously we could do little. The honor system, to be effective, must be practically perfect, but the honor spirit, even in a small portion of the whole, will have a wonderful influence on all our life and work at the Institute.

Why could not the president of the senior class, and the institute committee invite to an open meeting all men interested in this subject and at that meeting ask those so inclined to sign their names to a pledge on honor never to give or receive unauthorized assistance on an examination at the Institute and to try by personal example to establish and maintain a high standard of integrity in all their work. The objection will be raised that such a pledge would be signed by many merely for the appearance of honesty, and with no intention of keeping it inviolate. Of course there will be such men. But what will the number of these be compared with those who will help, and thus assured of sympathy and co-operation, will gladly pledge themselves?

Such a pledge as this should offer no hardship to a gentleman. Many of us have failed to maintain a high standard in our work for the simple reason that there is no recognized standard. We see a certain man whom we know to be essentially honest, take such-and-such a liberty, and another another, until examples may be found among representative men of all those shortcomings which tend to dull our integrity. This

as a condition is an established one, and its influence is very certain. All of us have felt it. It can be stopped. Let us make a sharp line between the honest and the dishonest, and let us force him who would cheat to go to the lower ranks for [illegible] of the faculty, but we need have no doubt of obtaining it. They will in a large measure decide on the boundary line. It will be for the students to maintain it.

THE MID-YEAR TRIP OF THE ELECTRICAL ENGINEERING SOCIETY

By A. EDWARD TUTTLE, M.I.T., '17

Editor's Note. How much do you know about the conditions in present-day electrical engineering practice? Mr. Tuttle here describes what they did, and why, on the recent mid-year trip that several members of the M.I.T. Electrical Engineering Society took. Unless you have gone on a professional society trip you will not be able to understand why it is such a valuable asset to the undergraduate as well as to the graduate, for at present you do not know what these trips are like, or what the men do on these trips.

THIS year the mid-year trip of the electrical engineering society was without doubt a most instructive and successful one. In spite of the fact that the weather was poor the greater part of the time, the good humor of all was most apparent. The jolly good times in the trains, at dinner, and at the theatres will long be remembered by the fellows.

The fifteen men who composed the party with Mr. Schurig and Dr. Wiseman in charge left Boston Sunday evening, in company with the members of the musical clubs, for New York. They had a special car for Fall River where they boarded the boat. That evening, through the courtesy of the engineer, they were allowed to inspect the engines and lighting plant of the boat. The fog, which resulted in much loss of sleep that night, was still so thick in the morning that the boat was obliged to anchor off Sandy Hook. Since the fog had not lifted by ten o'clock the next morning the members of the electrical party enlisted the services of a summer excursion launch, which had come out to see if any one was sufficiently desirous of getting ashore to part with a portion of their finances, and were put ashore at Glason Point, where they got a car down town. After checking their baggage at the Twenty-third Street Ferry they went to the New York Electric Testing Laboratory where they spent what remained of the morning. Here the commercial tests of lamps, resistance, coal, instruments, and insulators with the various precautions taken to insure sufficient precision in the results were explained.

After a lunch which was provided by the company they were allowed the use of an automobile to take them to the Power Station of the Interborough Rapid Transit Company.

Here they were divided into groups and taken through the plant from ash pit to control board. They saw here a rotary converter set which furnishes power to the surface lines of the company operating on 6th and 7th avenues. Finally they were taken up stairs where the control system of the Westinghouse type with the methods of equalizing loads was explained to them in conjunction with the log sheet. This station with its battery of eighty-two automatically stoked boilers, its enormous condensers and large generators deeply impressed the fellows with its magnitude.

Upon leaving this plant the fellows walked through to Fifth Avenue where they took a bus to Twenty-third St. This view of New York at its busiest time, and that which they had of it all lighted up as they went down the river on the ferry are long to be remembered by those who had never been there before.

Arriving at Philadelphia while on the

way to Green' Hotel they were mistaken by people in the car for the Ford Peace Party until someone more observant than the rest remarked that they were altogether too jolly for that crowd!

The next morning they went to the plant of the Electric Storage Battery Company where the "Exide" and "Ironclad" storage cells are made. Here the complete processes of the manufacture of lead storage cells were shown to them.

After getting [illegible] a car for the Midvale Steel Works at Nicetown, Pennsylvania. Here after being divided into groups of five they were shown the manufacture of armor plate from furnace to planer and the pouring, forging, and rolling of steel. The magnitude of the steel industry was very deeply impressed upon the minds of the men when they saw one of the big open hearth furnaces being poured and some

THE "BUNCH" AT PITTSBURGH

The buildings were laid out in such a manner that the fellows were able to see the construction of the battery in a systematic order and to follow the different processes in their natural sequence. A demonstration of the strength of one of the cells was afforded them when one was thrown onto dead short circuit, allowing over four thousand amperes to flow. It was then short circuited through a three-eighths inch square bar of iron, which in a few seconds melted and fell apart.

of the big twelve inch guns which were being made for the U. S. Navy, in the different stages of manufacture. They were finally taken through the stock yards where they saw the large electro-magnets on cranes handling pigs of cast iron as though they were but needles.

Arriving at nine o'clock that night in Washington the men walked up to the Congressional Library and enjoyed a half hour admiring the beauties of the building when lights [illegible] was spent at the New Cochran Hotel and in

the morning Professor Hudson, who was to take the place of Mr. Schurig, who left the party at Philadelphia, joined them.

At the Bureau of Standards, where they spent the morning, the heads of the different departments explained the methods of determining the standard units of electrical resistance, conductivity, electromotive force, current capacity, and inductance. The complete equipment of the bureau was shown, and many of the problems now being worked out were discussed. In showing the apparatus for high tension insulation tests the safety device for the protection of the operator was carefully explained and guaranteed both fool proof and "Damn proof." After inspecting the testing material laboratory, they repaired to the lunch room of the Bureau. Here a novel method of choosing seats at the tables was explained to them, by which the director was just as liable to be seated between the elevator boy and the janitor, as beside the heads of any of the departments.

Upon leaving the Bureau, they went back to the hotel where they engaged an auto bus to take them around the city. When they had covered a greater part of the city, they were left at the Capitol where they had the opportunity of seeing both the Senate and House in session.

ONE OF THE POWER HOUSES AT NIAGARA

A special rate was accorded the party at the hotel for a most excellent table d'hote dinner. Here Dr. Wiseman, who is short and of small capacity, gazed in rapt astonishment at Professor Hudson who filled his six foot 10 inches with everything on the bill of fare from Blue Points to Café Noir. After the meal, about half of the party went to Keith's; where the rest went is still a mystery, all that is known is that they caught the midnight train for Pittsburgh with the rest of the crowd.

After checking their baggage upon their arrival at Pittsburgh, they took a train for the Westinghouse Electric and Manufacturing Co., at East Pittsburgh. Here they were given a short talk by Mr. Dudy, who pointed out some of the opportunities of future employment for them, and explained the different departments of the company, and their apprentice system. The rest of the morning was spent in inspecting the manufacture and testing of electric motors and transformers. The large scale production of the plant and the manner in which almost ever available inch of floor space was in use was quite impressive. Upon the invitation of the company, the party had lunch at the Westinghouse Club. In the afternoon, they took in that portion of the factory occupied by the manufacture of oil switches, switch-boards, rheostats, and other smaller apparatus. Upon leaving the factory, they caught a train back to Pittsburgh, and after having supper, left for Buffalo. Reaching Buffalo at nine thirty, the party went to the Y. M. C. A. Men's Hotel, where they obtained accommodations for the night.

The next morning, upon arrival at Niagara, they registered and left their baggage at the Hotel Clifton, Then they went to the plant of the Niagara Falls Power Company, which supplies power to the Acheson Graphite Co., the Carborundum Works and the City of Buffalo, where they inspected the large vertical Hydro Electric Machines, and the company's transformer station. After having lunch, they went to the Acheson Graphite Company works, next door. At this plant they saw the large electric furnaces which convert carbon, as coke, to the form of graphite at between two and three thousand degrees Fahrenheit. They saw the different furnaces in the process of being charged, during the different stages of the operation, and finally the removal of the finished product. Upon leaving the Graphite Company's plant, they walked over to the Race Division to the Shredded Wheat Company, where they were courteously conducted and shown through the plant. Then they went to the Hydraulic Company's plant where the thirteen large Hydro Electric Units with a maximum capacity of ten thousand horse power each, were inspected. They then had lunch and spent the rest of the afternoon in sight-seeing.

The fellows had the opportunity of viewing the Falls all covered with ice. Some of the men, more venturesome than the rest, donned rubber coats and went down to the Cave of the Winds under the Falls. It afterwards proved that because the coats were incapable of keeping out all the moisture, several of the fellows were obliged to spend the evening wrapped in blankets beside the steam radiators in their rooms, while the others went to the movies.

The next morning the party crossed the river, and inspected the Ontario Power Company's plant. Here they saw fourteen hydro-electric generator units, with a total capacity of one hundred and sixty-nine thousand horse power, in operation. When the different details of the motors and generators had been carefully pointed out to the men, they were taken to the transformer room. Here the voltage is stepped from twelve thousand to thirty thousand volts. After inspecting the control system, and having the log-sheet explained, they went to the "Hydro-Electric Power Commission," through which goes all the power of the Ontario Company used in Canada. This plant, which is primarily a transformer station, steps the voltage used for long distance transmission, up to one hundred and ten thousand. Here the methods and precautions used for [illegible]

lightning were explained. The fellows then returned to the hotel, and after getting their baggage, took the train back to Buffalo. That afternoon, the majority of the fellows went to see "Twin Beds" at the "Star Theater." They then went out for dinner and boarded the train for Boston about seven thirty. The evening was spent in playing cards, reminiscing and "jollying" "Gawge" the porter. They arrived in Boston the next morning, broke, but happy.

This trip not only gave the fellows an opportunity to see large plants in operation, and to get an idea of what they may be called upon to do when they seek employment; but also a large, broad conception of the engineering world which they could not otherwise have gained.

I am sure I have the sanction of the other members of the party when I extend the thanks of all to A. E. Hanson to whom, on account of his interest, good judgment, and careful planning, I attribute the success of the trip.

HOW UNDERGRADUATES CAN HELP AT THE DEDICATION

By JOHN RITCHIE, Jr.

Editor's Note. The plans for the dedication of those masterpieces of architecture that are nearing completion on the other side of the Charles as Technology's new home are attracting the attention of the entire country. No dedication has ever been so elaborately planned. If you desire to fulfil your obligation to Technology this June, you may well hearken to what Mr. Ritchie has to say.

IT has been quite customary in the past for the students of the Institute to leave Boston immediately upon the graduation exercises or even before that day, but there will be excellent reasons this year for delaying this departure in order to view and probably be active in the dedicatory exercises of the New Technology. It is no strange occurrence for the students to depart thus quickly, for even in 1880, Professor George H. Barton notes in his reminiscences, one of the students left the platform during the graduation exercises to catch the train for his promised situation, and the call of places open to M. I. T. graduates has never since that day abated. Then there are many students from a distance whose desire to reach home for the all too brief summer vacation is a laudible one; and there are others who for divers reasons leave the city at the earliest moment. To all such men, the advantages of remaining three days longer in Boston to witness and be participants in the splendid serious, as well as entertaining spectacles, are not to be set lightly aside.

Some one has somewhat irreverently referred to the exercises in June, the days being Monday to Wednesday, 12-14 as a "three-ringed circus." It will literally have three foci of interest; senior week with everything which that means to the students will just be closing; there will be a gathering of alumni in this city such as few colleges ever welcome to their halls; and from every seat of learning in the world delegates will be in attendance to grace the simple exercises of dedication. The constant background will be the kaleidoscopic gatherings of the alumni. They will group themselves in classes and in courses; they will gather at the farewell to Rogers in Huntington Hall, at the golden jubilee smoker, and at the final cheering of the old buildings from the Rogers steps. In lighter vein they will assemble at Nantasket to repeat in glorious measure the enjoyments of similar occasions in the past. The alumni will form the background and the audience of the splendid masque which is developing itself under the skillful touch of Professor Cram and his committee, and they will again be the auditors in the great central court of the New Technology to the simple forms that will dedicate these palaces to the cause of education, and in Symphony Hall they will crown the fiftieth anniversary of the founding of their Alma Mater with feasting, sentiment, oratory and song.

Upon this variegated groundwork the students will weave continually their parts in an active pattern brimming with life and helpfulness. On Monday they will have ceremonies of their own, but

a goodly number will be in attendance at the new buildings. Here the plannings are most interesting. A hundred officers or more, with uniforms and side arms, will be stationed each in his hall with ample guard. These will be the guides to the buildings and each group will have in mind the layout of the structures. Hundreds of visitors will be inspecting the edifices, and many of them former students with definite desires in mind. The visitor asks of the nearest officer, a guide is detailed to conduct him, and presently, in the most efficient way, he will be presented to the officer in charge of the desired department, who will see to it that he finds what he wishes.

Such work, and so cunningly planned, will be of the greatest interest to the students. Important men from everywhere will be seeking information and the acquaintanceships formed in this way may lead no one can tell whither. Then again there is to be the great parade. Few realize the number of kinds of preparedness that are easy to Tech men. It is proposed to make a showing of the military strength of the Institute by a parade within the great court. It will be no great difficulty to muster a thousand or fifteen hundred students who have had a year of training, and there will be no problem in officering such a regiment with students skilled in commanding. A dress parade of this regiment will speak more for the all-round education of the students, and give a more impressive notion of what it means to have ten thousand alumni similarly educated, than would volumes of description.

At the golden jubilee smoker at the City Club the seniors will have entrance and will be, in truth and in effect, alumni. There will be here the most important gathering of the men who have made technical America that has ever come under a single roof, and the opportunity will be a rare one for those just starting in their careers, while the real farewell and cheering of Rogers from the famous steps will be a feature never to be forgotten. From the City Club there will be a procession of alumni, probably four or five thousand in number, bearing class banners; the ladies will have been in care of the alumnae at one of the hotels near Copley Square and will then be delivered to their husbands and escorts while the undergraduates will be gathering n groups, till the old Rogers building will see assembled such a company as never before. There will be cheering and singing, and for the last time salutes to the earliest home of the M. I. T. Bands will help enliven the scene; there will be student choruses trained for leaders in the singing and the cheering—well everyone knows the precision with which this is done and it will be emphasized by the fresh, strong voices of the class of '16.

Tuesday the alumni will transfer their activities to Nantasket. Here will be repeated the triumphs of 1909, still held in pleasant memory, but glorified as the increase in technical skill since then will warrant. There will be an armada of steamboats to convey the throng down the harbor; there will be a procession on the strand; and then will follow the exhibition of the mascots and the unravelling of the class stunts.

Meanwhile the senior class will be following the program of the graduation exercises, while the undergraduates will be on duty at the new buildings. In the evening all the interest will be assembled for the pageant and masque. The grand court of the New Technology will furnish its scenery, a setting that everyone agrees is unique in the country within the limits of a great metropolis. Here ten thousand spectators can view at their ease the marvelous scene. Out through the court will be the placid waters of the

Basin, rimmed in the distance with the twinkling lights of the city a night drawn on, and on its bosom the brilliant lanterns of hundreds of flitting launches. The building themselves will be illuminated with that marvelous delicacy that characterized the lightings of the San Francisco exposition. The same artist will be in charge, lent to Technology by his Schenectady company.

In the middle of the court will be a great circle. It will be fitted with all the cunning devices of the modern stage, spot lights will illuminate special features, flood lightnings will bathe the whole arena with the semblance of daylight, and from subterranean caverns vertical rays will give most extraordinary effects.

An arena it will be in truth, for here will be delineated step by step by the students, man's progress in conquering the forces of nature. The huge circle will be filled with a thousand or two of elements in chaos and confusion, a magnificent spectacle of un-co-ordinated, crude, jostling forces. It will be a world formless and useless. Primordial man views this world, he seeks to conquer it and enters the circle, but again and again is flung out by the forces that do no know his bidding. Growing more and more intelligent and calling to his aid the great principles which education places at his command, man subdues chaos, and order and civilization are established. Then for the finale the Old Rogers may in some

[illegible]

On Wednesday [illegible] ceremonies of the Institute [illegible] presence of representatives of country, state and municipalities, in the midst of a gathering from [illegible] everywhere, supported by countless alumni and undergraduates, with exercises as simple as the other occasions have been complicated, the few brief addresses will be voiced that will celebrate the semicentennial of the Institute and will declare the New Technology to be at the service of the world.

Throughout the day there will be meetings of the few or many, visits to the new buildings and to its wonderful museum. This has not before been mentioned, but it is proposed to have here an exhibition of the scientific progress of the past fifty years, which will in itself be a marvel, and as such, one element in the whole remarkable celebration.

In the evening the alumni will gather in Symphony Hall for the great final banquet, the climax of the occasion, where oratory, feasting, Technology spirit and scientific surprises will be the order of the evening.

These are the outlines of an occasion which M. I. T. students can not afford to miss, and in which as many as wish, and this number should not be small, may add to their own enjoyment as well as that of others by giving a helping hand.

THE TECH METHOD OF TEACHING

THREE REPLIES

Editor's Note. The following article, like that by a successful recent graduate of the Institute published in the March issue, brings up a question seldom considered by the undergraduate. The following are the best of the several replies that we have received. The question is of vital importance to us.

The views expressed are not in any sense opinions authorized by the editors, and *The Technology Monthly* does not accept responsibility for the statements made therein. They are published solely to present to our readers the opinions of serious-minded thinkers on technical education. As is customary in cases of this nature involving a two-sided discussion, the pages of *The Monthly* merely constitute a Forum for the exchange of opinions.

By EDWIN TUTTLE COLE

Major, United States Army, Professor of Military Science

I YIELD rather reluctantly to the request to say something on the subject of the "Tech Method of Teaching" and the opinion expressed thereon by a recent graduate. Criticism of any institution is like that of members of a family, and is the more kindly received from inside sources. We might think the conduct of a sister open to criticism, but would forcibly resent such an opinion from an outsider. One would have to go far to find a more loyal Tech man than I am, but I am not one of its educational products. I yield, then, to the request because I think most, if not all of the criticism in the article in question, is both unjust and not based on careful thought or maturely weighed judgment.

The criticism is given as that of a recent graduate. I am not of those who hold that a criticism to be of worth must be signed, for so much of it as rests on unanswerable argument gains nothing from a knowledge of the personality of the writer; but in this case we are confronted almost purely with statements of opinion, and it would be of immense value in determining the value of these opinions to know how long ago the writer graduated, how much trouble he had in getting through, and how successful he has been since graduation. All this because it is by no means uncommon for some men too near to undergraduate life to feel that they hate the school in which they have not gained the measure of success anticipated, and that they never want to see it again. I have heard men declare they never wished to lay eyes on West Point again, yet who in later years would cross the continent to attend a class reunion there. This feeling of distaste is intensified in some men by disappointment during the course, or failure to see as immediate beneficial results in the battle of life as were anticipated. Looking over the subject matter of the criticism I cannot help but feel that it is tinctured by some or all of these facts, and I doubt very much whether the critic would hold to his views in a few years.

Let us examine some of the criticisms:

1. The health of many men is impaired for years after graduation.

I have had occasion as a member of the Scholarship Committee and in rather intimate association with a number of students to make careful inquiry as to the reason for poor records. I do not remember a single case where ill health has ever been urged as an excuse for more than temporary deficiency, while in nearly every case the student has frank-

ly admitted that he has, either through choice or necessity, put too much time on matters outside of the course. In a few cases I have known of lack of sufficient rest through giving study time to pleasure, and sleep time to study. The Dean agrees with me that broken health through over study is practically if not absolutely non-existent.

2. Morals were so upset and views of life so distorted that it was only with the greatest effort graduates became normal again.

This is a very grave charge if backed up by evidence showing what it means, but in its present indefinite form means nothing. I have never heard before any charge of a definite nature remotely resembling this, nor have I heard the vaguest hint of anyone who is in any way doing anything to injure the morals of students. It is hard to grasp what is meant. If the meaning is that the work is so hard as to lead to dishonest methods or cheating to get through, it would be foolish to talk of becoming normal again. A thief or a liar is so from lack of principle, and to become honest would have to become abnormal. If the meaning is that so much science disturbs religious belief, I cannot agree, for if anything will promote belief in a Sublime Being which logic applied to the orthodox tenets of religion might reject, it is the wonder of the universe as revealed by scientific study. One cannot imagine the beautiful balance of the known universe, the laws of chemical affinity, for instance, as just happening. It is difficult to argue against this damage to morals which is twice mentioned by the critic and claimed to be so serious that many recent graduates would not send their sons to Tech, because I, who believe I am about as close to the student body as any other member of the Faculty, have no idea what he is talking about.

3. It is [illegible] that he tackles his problems in the hardest way, etc.

Of course he does. Tech is a college specializing in technical matters and is not a trade school. A man needs to learn the theory which governs the practical operations and needs mental gymnastics to develop his brain and teach him how to reason and to plan. Much of the information he gains in school by laborious reasoning and solving of long and difficult problems, in actual practice thereafter, he gets out of a table book. Does the critic hold that Tech should confine itself to teaching men to use table books? Much of that work is done in offices by underlings who have no conception what the tables mean. In another place he complains that the student is given special cases instead of general problems. This is too inconsistent with the other complaint to notice.

4. Members of the Tech instruction staff learn all they know at Tech and consequently the sum total of knowledge is growing less every year.

This statement is almost too unconsidered and illogical to notice. What a boy learns at school and what a man can develop from that basis are as far apart as the poles. If Tech is a great institution for teaching its particular line of work, then it is a fine one for educating instructors in its line. I suppose the idea of the critic is that no student knows on graduation as much as his instructor, and if he in turn becomes an instructor and turns out a man who knows less than himself, that in a measurable time we will reach an instructor who knows practically nothing. If this is followed to its logical conclusion does it matter to what school it is applied, or where we get our instructors? Will we not have a continuous [illegible] all schools, and a perfect explanation of

why the world is so far behind the middle ages and fast approaching a state of imbecility? Teachers are born and not made, but so far as a basic equipment for a teacher is concerned, I cannot see where he could get it for Tech purposes better than at Tech. Other institutions certainly appreciate teachers who started at Tech. A man whose education is finished when he receives his degree would not be worth five hundred a year as a teacher or in any other capacity.

5. Tech is great—so great in fact that it overshadows everything else on earth.

She is your Alma Mater. If you cannot give her the love and loyalty you give that mother who has clear title to your love and loyalty, you have selected the wrong College foster-mother, and in this case you can and should change your allegiance at once to one you can love and reverence. If she does not agree with all of your ideas strive gently and with reverence to make her see your viewpoint; but meanwhile, to yourself and to all others assert and maintain as you would the honor of your real mother, that

"Tech is great—so great in fact that (to her sons) she overshadows everything else on earth."

By EASTMAN A WEAVER, M.I.T., '15

IT is much easier to rail against the instruction we receive at Tech than to show specifically how it can be improved. Its faults are those of present-day educational methods in general, accentuated in certain particulars; and improvement can only be attained slowly and at the expense of sustained constructive effort.

The fault most apparent to observers of our classroom processes is lack of "punch" on the part of the professors. This seems to result chiefly from lack of interest in their subjects, and secondarily from lack of confidence in themselves. Believing himself (perhaps subconsciously) incapable of carrying a class straight through a subject in a vigorous and thorough manner without waste of time, a lecturer falls back on the natural expedient of padding with sounding phrases of no clear meaning, lest the class be wholly unimpressed. The result aside from dilution of the real subject-matter, is a pronounced stupifying effect on the listeners. Perceiving that he is not "getting across," the lecturer decides that his introduction of the subject has been insufficient, and spends valuable hours rehearsing matter that his students already know, increasing the soporific effect and the general disgust with the course. This tendency is so widespread that the few exceptions to it (too well known to require pointing out), are universally regarded as the best professors to work under, though they have no more thorough knowledge than most of their colleagues; and solely because they make their points in an agressive, staccato manner, without wasting words or time.

A second shortcoming of the professors themselves is their inability or unwillingness to establish any kind of direct relations with the student. Even where the small number in a class renders personal knowledge feasible, the professor usually stays behind the impenetrable barrier of his dignity, with the result that at the end of the term he knows nothing of each student's understanding of the subject, and must depend for a basis of marks on that utterly unscientific and deceptive relic of medieval education—the examination.

More fundamental it less obvious that these failings is the oft-remarked defect of teaching particular methods rather than general principles. The first general step in modern educational evolution was from stuffing with facts to imparting methods; another, equally radical, is now needed the developing [illegible] for every class of problem, any more than he is the man with a head full of facts; he is the man with the ability to develop methods of treating problems. But it will be long before this is recognized in educational practice.

By AN UNDERGRADUATE

THE article in the recent issue of the *Technology Monthly* concerning the "Tech Method of Teaching" has excited, not only criticism, but clear thinking on the subject. For that alone the author deserves credit; because nothing so promotes analytical thinking and discussion as a sudden radical outburst. That "Tech Spirit is usually based upon a false foundation" I deny. I will not attempt to define "Tech Spirit," but we've got it, and didn't get it falsely. Tech Spirit is responsible for the magazine you are reading this in, and Tech Spirit is going to do big things in June, The gist of the story comes down first, to the narrowness of the average Tech man's education; and second to a criticism of the instructing staff.

I was talking with a sophomore the other day about the former, and in reply to my plea for a broader education he replied: "But I didn't come to Tech for a broad education. I came here to learn chemistry, to specialize; and if I wanted broadening I would have gone to some other college." It may be excusable for a graduate of some other college to take that view of the work here at the Institute; but the party in question was not a college graduate, just as are two-thirds of the students here. If Technology cannot teach him the value of breadth, then Technology has failed in one of her fundamental aims. I refer to the motto hung up in the Union dining room by President Maclaurin: "To train men liberally to be makers in Engineering, Architecture, and Science, and to give them the will and the power to serve the State by the Scientific Method and with the Scientific Spirit."

In one of the published addresses of Dr. Nicholas Murray Butler, now president of Columbia University, I find the following: "The insight into self-activity and the primacy of reflective thought, I regard as the profoundest that education has to offer." The value of your education at the Institute may be measured in a way by your ability to collect your ideas and to think out clearly the solution of a problem. Since we are preparing ourselves to enter the field of science, it is essential that we understand the scientific terms we will meet; the language of science. By that I mean that we must have a foundation in mathematics, in physics, in applied mechanics, and all the other rocks and branches by which we pull ourselves upward. But, unless we possess the ability to grasp a situation and pick out the salient points; these assets become as a slide-rule in the hands of a butcher, - a very good tool if he knew when and how to use it. It is characteristic of Tech [illegible] analyze a new problem.

One of the best arguments against too intensive specialization in our work at the Institute, lies in the fact that so

many men enter fields entirely foreign to the courses they studied here. At a dinner in February I enjoyed the company of a typical Course VI graduate. Was he associated with the General Electric Company? Or had he entered the Westinghouse apprentice course? No! He is in the *purchasing department* of a non-technical company, and overflowing with enthusiasm, for, what is to him, an entirely new field.

Let us see to what degree specialization is carried in Technology. It is really begun in the second term of our first year, when those entering an engineering course are segregated from the chemists, physicists, and architects. The engineers begin to branch out into their respective lines in their sophomore year, but it is noticeable that the electricals are getting their broad foundation, until they are plunged into the intricacies of the Principles of Electrical Engineering in their third year. It might be better for some electricals to get a taste of what the faculty have in store for them during their second year, and thereby rectify an unwise choice of course. The recent revision in the physics course may be indicative of some such move. And conversely, if there is any talk of narrowness we should expect it to flow from the architects or chemists.

It is with the already intensified courses that the rub comes. How on earth can they be broadened out to satisfy the requirements of that growing body of people, who are represented by the author of the article inciting this one? Look at chemistry! The Powers that Be have ordained that the embryonic chemist shall put in a share of his first recess here, in Boston, dissolving his precipitates in perspiration seven hours a day; and grinding Treadwell-Hall by night. I have a hunch the students do not all appreciate the value of a course so acquired. The advantage gained by the consecutive hours in the laboratory is advanced as an excuse, but this method has not been found necessary in any other course. The truth of the matter seems to be, that the tremendous advance in the science of chemistry during the past decade has made it imperative that the faculty strengthen and intensify the course; which was already so full that any addition simply had to overflow into summer work. When a science advances in such degree, and it is not deemed advisable to curtail any of the lesser studies, it seems to me that the logical thing to do is to extend the work into a definite five year course. Such a procedure would give some hours to spare for the much needed general studies. Economics of Corporations is required only in Course VI, but it is just as important to the chemical or mechanical engineer as it is to the electrical engineer. Few of us appreciate the value of general studies. Courses in psychology and in philosophy would be a mighty good addition; and when so many of our assistants, and ultimately our instructors, come directly from the graduates, it seems as though a course in pedagogy would not be amiss.

Undoubtedly the degree of specialization at Tech is due to the rapid advance of science in the past score of years. In keeping abreast of the times the faculty has been forced to add courses from time to time, gradually narrowing our outlook. The founder of Technology instituted a school for liberal education. Are we getting it?

One of the greatest advantages of a compulsory five year course with 600 hours required instead of 720, would be more time for activities. We get, and always will get, most of our "Human Engineering" by going into actitivies. They are the phase of institute life that

teaches men initiative, develops their tactfulness and organizing ability. It teaches them how to handle men instead of formulas. But consider the reward of that versatile man who chooses to become embroiled in the intricacies of Tech Show, Technique, and the higher positions in other activities. His degree is invariably jeopardized thereby, usually coming a year late,—often not at all. No one questions the value of an interest in activities, but we don't have time to do it right and get our lessons too.

Now let us turn to the second chapter of the story. Technology is noticeably inefficient in one particular. There is too often an apparent lack of co-operation among the various departments. For instance, the Course VI men are taught to think in terms of force throughout their second year, in physics and mechanics; but upon entering the third are impressed with the necessity of revising their conceptions entirely. They must forget Force and think in terms of Energy. It does not take much thought, or research, to see that the latter conception is the truly fundamental one. All the various branches of science, whether we turn to physics, mechanics, or biology have their foundation in the great laws of the conservation of matter, and of the conservation of ENERGY. Force will solve our mechanics problems; but for the theoretical chemist as well as the electrical engineer it is entirely inadequate. Recourse must be made to ENERGY. Why then, are we diverted at the very start of the game into the applications of the idea of FORCE; when we must ultimately return to ENERGY for our truly fundamental conceptions?

There seems to be a certain reticence among the professors and instructors in showing the student that all primary formulas are only the law of the conservation of energy, expressed in the shorthand of their branch. We are generally told the relation once or twice, and then forget it. We forget that F = Ma as well as Bernoulli's theorem are expressions of this law, and that Kirchoff's law for a closed circuit is only a restatement in electrical short-hand. Many of our instructors try to impress us with these truths, but a great many appear to become so absorbed in advancing that they omit to lay the emphasis on the foundations, and too often fail to show clearly the logical steps in the development of the subject. As we study we have little or no idea of the salient points, and are just as apt to spend hours on unimportant details. Perhaps they do not thoroughly understand the minds they are trying to develop.

I think no one can deny that many professors are not good teachers. Too many instructors are chosen from the ranks, not because they have the rare gift of being able to impart knowledge, but simply because they have the large fund of knowledge themselves. So far as I know there is no method in operation here, whereby our instructors are chosen because they have the ability to teach. The primary requisite of a good teacher is breadth. He must have the thorough understanding of his subject, and in addition must be able to put himself in the student's place, and see his viewpoint. No man can hope to be a really successful teacher unless he has a clear conception of how the student mind works, and how it grasps the ideas he is trying to impart. There are professors in the Institute who possess the rare gift of being able to understand the average student; and who can explain their ideas so the student will grasp them easily, and leave the lecture room with a clearer understanding than when he went in.

cate problems, and too often leave us at sea as to the fundamental laws governing all, which, if we could but grasp, if we only had pointed out to us, would unify the whole, and help us to correlate instead of memorize.

I realize that my education has been limited, it has only just begun, and if I have had to choose my examples from a few courses I hope I may be forgiven. It is a mistake to think we are thoroughly educated when we leave Tech, but have we as broad a foundation as we could have,—are we trained to think?

ENTROPY OF CIVILIZATION

By HENRY F. GOLDSMITH, M.I.T., '17
A. B., University of Pennsylvania

Editor's Note. It was back in 1776 that the idea that "All men are created free and equal" was first propounded. We still believe that it should always hold before the law. It forms the basis of Socialist doctrine.

It is obvious to every one, especially if we believe (and as scientists we cannot avoid believing) in the Darwinian Theory, that at any stage of life all people are not equal, either physically, morally, mentally or in any other way. Mr. Goldsmith [illegible] to make us [illegible] thinking.

THOSE who, with varied fortune, have encountered that "ghostly quantity, Entropy," have found it to be the measure of heat waste, of energy dissipation. To encroach further on Professor Berry's preserves, according to the first law of Thermodynamics the AMOUNT of energy in the universe remains constant—energy can neither be created nor destroyed. But it can be, and rarely is, dissipated and made unavailable for further use. As an example, if all the water in the rivers from which we obtain power had flown to the sea, the water would be the same in amount, but useless for more power production. It has reached the tide-water level. And toward that tide-water level all the other energy of which we have conception is verging. When it gets there we shall still have our energy but we shall not be able to profit by it.

In other words, we need differences in heat, differences in water head, before we can utilize the energy inherent in these things. And the greater the difference, the greater the availability. And yet, knowing these things, and regulating our daily lives accordingly, we are trying to do just the opposite in shaping our human progress—we are aiming toward the dead level, toward back-water stagnation. We see a waterfall with a two-hundred foot head, say. "Magnificent" we exclaim. "What tremendous power is there." Power is there because of the difference in [illegible] the back of the mountain [illegible]. But we do not [illegible] in their energy, "[illegible]" human affairs, two states of widely contrasting strength [illegible] say. "The [illegible] must be brought to equality [illegible] other; these states, they cannot remain [illegible]. One [illegible] other stronger."

This so far has been our conception of justice, of the highest progress for humanity. To-day we are nearly on the crest of that philosophy. "All men are created free and equal," we shout—we to whom the [illegible] much and the fact so little; we who have never known equality, and have never really wished it. Today we are at one of the turnings of the road. The leveling process must either continue; the differences between men must be pressed out or we must desert our philosophy in words as we have always done in fact, and turn about on another road.

That entropy among men is on the increase can hardly be disputed. The [illegible] is founded on the supposition that men are created free and equal. The germs [illegible] had their conception in the seething fer-

ment of the French Revolution, ideals which the French themselves repudiated with violence—liberty with a Robespierre, equality with a Bonaparte. These were the ideals—complete grading down, bringing to a dead level all the highest and the lowest. Our history, of which we are proud, is sufficient proof that we never attempted to live up to them. We created differences between men, those who were created unequal were enabled to make the gaps the greater. Until today, when with our policy of standardization, our love for minute organization, our huge educational mills turning out men who have been cut and chiseled into a form which approximates as nearly as possible the ideal mold, today we are nearer to realizing what true equality means, today some people are wondering whether entropy in the quality of men should be increased.

Today we are on the verge of a decision because the titanic struggle abroad at its conclusion will furnish toward a solution its armored hosts,men with guns in their hands, men who will not trifle,men who have learned the meaning of command and obey.

This leveling, this development of the gregarious ideal, this idea of the blessedness of the common people, because it is the common people, has its chief propagandist in Socialism as many Socialists understand it; it is the backbone of Democracy as most of us conceive Democracy; and the ultimate aim of Christianity if we are to accept the high priests of the church. The process has been going on for years—"it was, in fact, that the revolt of the slaves begins in the sphere of morals; that revolt which has behind it a history of two millennia, and which at the present day has only moved out of our sight, because it—has achieved victory."

As well as we know that all energy is not equal in quality or availability, so well also do we know that all men are not equal in quality, equal in ability, equal in possibilities of development. And it is on this inequality that we in the past have depended for many of our forward strides. "A man's a men for a' that." Very true; but some men should lead, others follow; some rule, others obey. It is the differences between men, the differences in their ability, in power, in might, not an unvarying sameness among them, that makes for progress. At least, such has been the cry. Does the analogy hold here? Ought we not take all possible steps toward preventing this increase in entropy among men, this gregariousness, or does the analogy break down, should all of us be trained to tide-water equality?

Nietzsche — that much maligned propt of the aristocratic ideal—Nietzsche it was who first decried this whittling down of the differences between men, the coming "green meadow happiness of the herd." He saw it as a great danger. And in opposition to it he fashioned a fantastic philosophy. Yet despite his extravagance, hardly a leader has risen since his time who, like Ibsen, like Strindberg, Shaw, Suderman, Theodore Roosevelt, Kaiser Wilhelm, has not been quickened and influenced by the sledgehammer blow of his words.

Nietzsche it was who insisted on this difference, the "pathos of distance" between men, as the basis of all progress, and his Supermen were those who, by the very magnitude of their superiority, were to lead the advance. He pictured them as men of action, of great bodily force and might, as based on "a careful cult of the physical, on a flowering, rich, and even effervescing healthiness that goes considerably beyond what is necessary for maintaining life, on war, adventure, the chase, the dance, the

[illegible] journey on everything, in fact, which [illegible] is based on free, strong and [illegible] action."

Whatever the objective may [illegible] words, and whatever his influence in leading the Germany of today astray in the dreams of world power and domination, the fact remains that he first made the sharp contrast, he first raised as a problem the question, "Should differences among men be emphasized, or repressed?"

And the Germans, who of all peoples have been turned out in a mold most uniform, drunk in his poetry as gospel, and conjured up for themselves world empire, with their own nation as the masters, and the rest of the world as slaves. As a result, everything has gone into the balance, and for that very reason challenge to democracy, the democracy [illegible] alone for on that count democracy so far has been a humiliating failure but a challenge to democracy as a rational point of view, as a workable basis of civilization, as a cult on which to build the foundation of an enduring progress. It is this concept which is being weighed in the scales of judgment, the concept of reduction to dead level of equality, all ability, all initiative, all the energy factors of man. For this democracy is that which we too much preach, and which, whatever side wins the present struggle, shall have to stand on its merits in the post-bellum readjustment. It is the problem of the ever increasing entropy of civilization.

EDITORIAL SECTION

The Technology Monthly
and Harvard Engineering Journal

A Magazine devoted to the interests of the Massachusetts Institute of Technology--The Official Organ of the Association of Harvard Engineers

BOARD OF DIRECTORS

Business Manager
RAFAEL ALFARO, '16

Editor-in-Chief
MAURICE F. BRANDT, '15

Acting Advertising Manager
H. P. GEISLER, JR., '18

Circulation Manager
J. H. STAGG, '17

Treasurer
R. H. CATLETT, '17

Publicity Manager
R. F. F. BROOKS, '17

Staff Photographer
F. H. NORTON, '18

Staff Artist
L. F. VAN ZELM, '18

GENERAL STAFF

F. C. HOWARD, '17
B. I. LEWIS, '17
G. W. ROOT, '19
R. K. WELLS, '19
F. H. WELLS, '18
H. F. GOLDSMITH, '17
L. I. NOYES, '17
F. M. BARNICOAT, '19
R. E. DEMERRITT, '17

General Offices of the Publication, 12 Trinity Place, Boston, Mass.

Secretary of the Association of Harvard Engineers, 218 Pierce Hall, Cambridge, Mass.

All Positions are open to competition.

All manuscripts submitted for publication in the TECHNOLOGY MONTHLY AND HARVARD ENGINEERING JOURNAL should be accompanied by the writer's full name and address. Manuscripts not accepted for publication will be returned only if the author so requests. Photographs, drawings, etc., will be returned to the contributor immediately after publication.

Forms close the 28th of the month immediately preceding date of publication. Material specially arranged for may be received up to the fifth day following.

EDITORIAL

IT is indeed fortunate that the Honor System [illegible] at the Institute at this period of constructive undergraduate thought. We are furthermore glad to have that group of men, led by Allen Abrams, who have seen the system working successfully in other colleges, and who believe that the honesty of Tech students, at least of the more developed upper-class men, is on a par with the honor of the men in other colleges. We welcome the trial of the system, among the upper-class men at least, with the unswerving belief that the undergraduate body is honest, and that the more developed of us can live up to the spirit and letter of this system for developing manhood.

WHEN you read "What Your Employer Demands," the editorial in last month's issue of The Technology Monthly, what did you think? Are you at fault, or is it the national educational system? Do you think that we should have fewer lessons so as to have more time for activities? "Your honesty counts more than your mathematics. Your loyalty counts more than your laboratory skill. Your qualities as a leader when placed in the balance of your value to your employer far outweigh all the proficiency you may gain in your profession by your four years' labor at Tech." It's that 87% that hurts.

THE article called "The Tech Method of Teaching" in the last issue of The Technology Monthly and Harvard Engineering Journal has caused considerable thinking on the subject. The three replies that we publish this month are selected from many that we have received. They give the opinions of a professor, recent graduate and undergraduate. The last paragraph of Major Cole's reply should form a slogan for all Technology men—it gives you what should be your highest ideal towards your Alma Mater– read it again.

TRUE TECHNOLOGY PREPAREDNESS

FOR fifty years we have been having [illegible] Technology. It was started when, right after the wilfully wasteful War Between The States, the absolute necessity for preparedness was appreciated. Since then practically every man who has entered Technology as a Freshman has been taught the rudiments of close order infantry drill.

Technology is an engineering college above all other things. In all of those branches of engineering which appertain in any way to civil engineering (which are similar to military engineering), the Institute has held undisputed superiority over all the other educational institutions of the country. Why, then, should not these men, leaders in their line, be taught to apply their knowledge and training to the military engineering necessities of the country?

In the establishment of our engineering corps, Technology has at last found her true and only field of utility in the preparation of our land for war. With

the best of training for engineers, our graduates would be wasting the fullest utility of their energies in war time if they did not put their life's preparation to the fullest benefit of the country. We are essentially engineers.

Major Cole has increased the efficiency of drill immensely since being placed in command of the Institute. His system of promotion of the men to the various grades of officers according as they have made good in the less important positions has increased the value of the men taking drill (especially of those men that continue with drill after their first year and rise through the various grades of commissioned officers), to the country in case of war. With this same system of training that we believe Major Cole is certain to introduce into the engineering corps, Technology men, when called upon to form the engineers of some future American Army, are sure to prove that we lead in all branches of engineering.

ANY ONE OF A DOZEN WAYS

"SUPPOSE you were a young graduate engineer," we recently wrote several alumni, "and suppose your employer put up to you a problem which seemed simple enough, but which, on account of your inexperience, you were unable to solve—what would you do?"

One of our former editors answered this communication as follows: "*Any one of a dozen ways will do.* Don't try to figure out the best way, or the cheapest way, or the easiest way; but accept the responsibility as it is presented to you—use the fact of your mental training, and answer. Answer something—quick and definite. Nine times out of ten, if you give your training a chance to assert itself, it will solve your problem for you, and consequently, nine times out of ten you will hit the wisest solution first, for you're a trained man. Forget your calculus and thermodynamics; their office was to train your mind for action—immediate, definite, conclusive action.

"In a pinch proposition all your knowledge of mechanics won't help you, neither will your familiarity with theoretical chemistry. But when the question is put to you, ANSWER. Give your reason for your answer, and give it quick. A reason a reason's—good or bad, it's a reason—given the first minute, it's probably worth your job; whereas a complete argument delivered months later is valueless. And remember, your chances of being right first time are ten to one—a pretty safe bet.

"Any one of a dozen reasons will do—just as any one of a dozen solutions to your problem is practicable. Be alert and active mentally, and when the question is put to you spring the solution which occurs to you at the moment—spring it quick, and you win." That's the answer.

HARVARD GRADUATE NOTES

'85—B. B. Thayer has been appointed on the Naval Advisory Board by Secretary Daniels.

'91—J. R. Finlay collaborated with other mining engineers in the publication of the Rules and Regulations for Metal Mines of the Department of the Interior, Bureau of Mines, at Washington.

'00—R. B. Bedford is manager of the eastern branch of the Clarage Fan Co., Singer Building, New York City.

'03—J. P. H. Perry was married to Miss Adele A. Lloyd, at New York City, on September 11, 1915.

'06—A. H. E. Talpey is employed with the Massachusetts Rating and Inspection Bureau in Boston.

'09—W. B. [illegible] October 15, 1915, to Miss [illegible] ton, at Turners Falls, Mass.

'12—C. H. R[illegible] tric Light, Power and Mines Engineering Department of the General Electric Co. at Schenectady.

'12—L. C. M[illegible] the engineering office of the Turners Falls (Mass.) Power and Light Company in connection with a test on their new 40,000 H. P. plant.

'14—W. N. M[illegible] Western Electric Co., Chicago, Ill. His address is 301 West Side, Y.M.C.A., Chicago, Ill.

HARVARD ENGINEERING SOCIETY OF NEW YORK

TWO meetings have been held recently by the Harvard Engineering Society of New York. At both meetings the members of the Yale and Princeton engineering associations were invited, and at the second, when the engineer's part in military preparedness was discussed, the invitation was extended to the Cornell Engineering Society and the Technology Club.

The first meeting was held January 29. About 80 were present. Professor J. B. Woodworth, '94, gave a stereopticon talk on the First Shaler Memorial Expedition, made to Brazil and Chile in 1908-09.

At this meeting the preparedness committee created at the meeting last fall, through a report by its chairman, Thomas Crimmins, '00, announced that plans had been made to have a series of lectures on military engineering. The meeting of February 9, at which about 100 members and guests were present, was the first of these meetings. It was addressed by Captain E. L. Robinson of the 22d Corps of Engineers, National Guard of New York, who illustrated his talk with lantern slides.

Since this lecture, on account of the beginning of a series of similar lectures in New York under the auspices of the national engineering societies, the Harvard series has been abandoned. It is reported, however, that a number of members of the society are availing themselves of the information given by W. L. Hanavan, '03, at the meeting of January 29, and are taking part in the weekly drills, Wednesday evenings, at the armory of the 69th Regiment.

Besides these two meetings, those who have availed themselves of it have recently enjoyed the hospitality of both the Princeton and the Yale Engineering Associations. On February 24th about fifteen Harvard men heard Thomas Riggs, Jr., Princeton, '94, member of the Alaskan Engineering Commission, and before that representative for the United States on the Alaskan Boundary Survey. His talk at the Princeton Club was on his experiences in the far North, and was illustrated with moving pictures. March 4th, the Harvard Engineering Society of New York was welcomed at a meeting of the Yale Engineering Association, the lecture of the evening being on the modern process of steel manufacture. This was also profusely illustrated by moving pictures.

LOCAL COLOR

FEBRUARY

By CARL J. HEATH, '17

Our Rifle Team can hit the mark
When shooting at a target.
The Wrestling Team has had a match
To-day at home against Pitt.
The Co-Ed has held some talks
That're really worth attending.
O'Hara's where
He split the air
And Sully's not pretending.

Technique is starting in to work
To feed a thousand diners.
The architects went on a trip
And saw some real designers.
One night the Chemists had a smoker
To drink their hardest cider.
A Co-ed slipped,
A Freshman tripped,
And sat right down beside her.

An Engine' Corps is being formed
To dig the warrior's ditches.
The costumes that the Co-eds make
Will cost them many stitches.
Some Tech Show trials are being held
And fill the Union diner:
Our Rufus White
Directs the fight;
A cast could not be finer!

We're back again at Tech once more
To start our arduous learning
Yet books are but a mere detail,
Our minds to Prom are yearning.
Four weeks have passed, our work
undone,
A month has gone in glory.
It Leap Year came
Each year the same,
I would make a longer story.

"REMINISCENCES—THAT'S ALL—"

THE BARBER SHOPS AT
THE COPLEY-PLAZA Boston
THE PLAZA New York
THE GREENBRIER
White Sulphur Springs, W. Va.
Are Under Management of CARL A. ZAHN

Kind old lady—I'm sure you will not mind my asking you, but are you a relative of Captain Jones, of Medford?

The officer—Madam, I *am* Captain Jones of Medford.

K. O. L.—Ah, then that accounts for the extraordinary resemblance.—London Opinion.

"Well," said the missionary, as he glanced first at the bubbling pot, and then at the horde of hungry cannibals, "they can say with truth after I am gone, I was one man in a hundred."—Widow.

"What' [illegible] your finger for?"

"My wife put it there [illegible] to post a letter."

"And did you post it?"

"No: she forgot to give it to me."—Cincinnatti Inquirer.

Pullman Porter—Next [illegible] station, sah. Shall I [illegible] now?

Morton Morose—No; it isn't necessary. When the train stops, I'll get off.—Judge.

HIGGINS'

DRAWING INKS
ETERNAL WRITING INK
ENGROSSING INK
TAURINE MUCILAGE
PHOTO-MOUNTER PASTE
DRAWING-BOARD PASTE
LIQUID PASTE
OFFICE PASTE
VEGETABLE GLUE, Etc.

ARE THE FINEST AND BEST GOODS OF THEIR KIND
AT DEALERS GENERALLY
CHAS. M. HIGGINS & CO., Manufacturers
Branches: Chicago, London 271 Ninth Street, BROOKLYN, N. Y.

Tech Show 1916

M 34

BOSTON OPERA HOUSE

Saturday, May 6th **Afternoon and Evening**

Mac—Yessir, my wife always finds something to harp on.

Tac—I hope mine does too.

Mac—What makes you say you hope that?

Tac—She's dead.—Cornell Widow.

YOU ARE WRONG

"Have a heart, will you?"

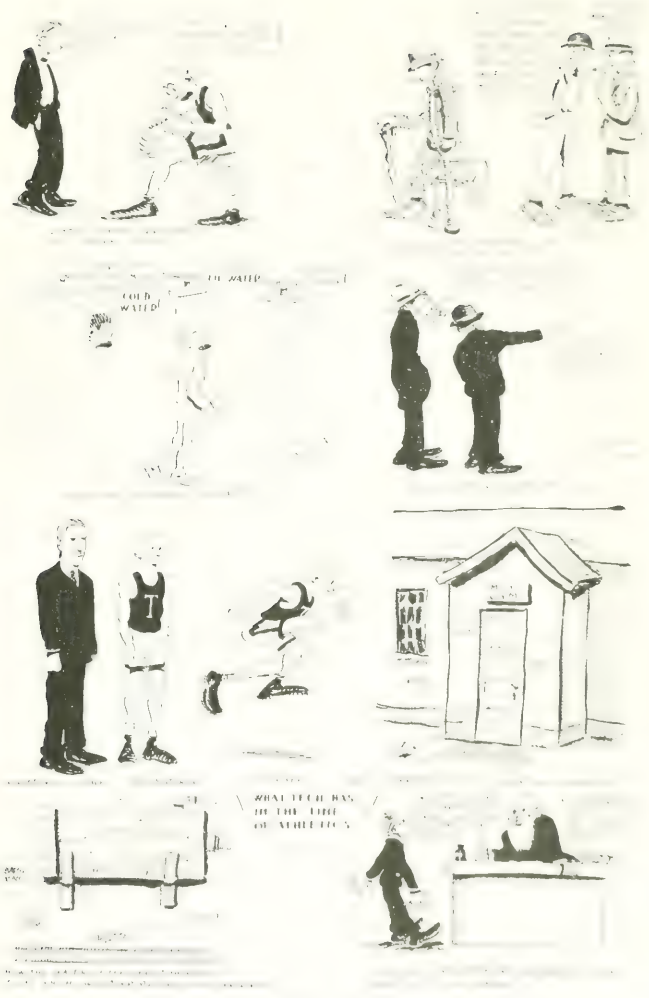
"Sorry, but I haven't," said the girl—and they lost the trick.—Michigan Gargoyle.

SAMSON SPOT CORD

For Sash Cord, Clothes Lines, Trolley Cord, Signal Cord, Arc Lamp Cord, etc.

Extra Quality, guaranteed free from imperfections. Send for sample and catalogue of all kinds of braided cord.

SAMSON CORDAGE WORKS, BOSTON, MASS.



NO—TECH DOESN'T NEED A NEW GYM

NEW YORK vs. BOSTON

Bausch & Lomb

Engineering Instruments

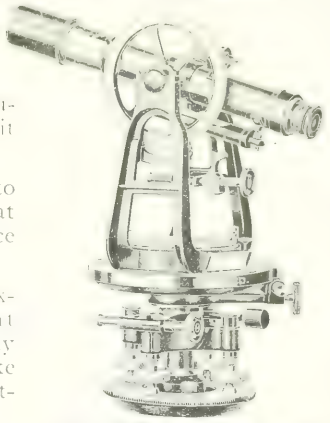
Consider the purchase of an instrument as an investment--you buy it for many years' service.

You would want an investment to give a certain return--you know what your requirements are for the service from a transit or a level.

Behind your bond there must be excellent security--an instrument would be no good to you if it merely served today and tomorrow broke down, and failing to hold its adjustments gave inaccurate readings.

Write for Metro Manual--our new handbook of unusual value to the engineer.

Compare with other instruments--then buy



Engineer's Transit. Special interior focus; Waterproof construction; Tarnish-proof graduations, etc.

Bausch & Lomb Optical Co.

ROCHESTER, N.Y.

CHARLES RIVER ANTHOLOGY

THE GRIND

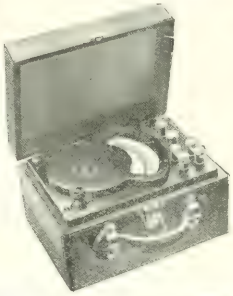
I belonged to one of the first families in town,
Living in a two-story house
With a furnace and piazza.
I always studied until nine o'clock
On every Saturday night.
On Sunday I attended the first Baptist,
And wore my black coat with cutaway front.
I never went to Austin & Stone's or the Bijou,
Or saw "Erminie" or "The Black Crook";
I got C's in Heat and Physics,
Harry Tyler and I had a future,
And he certainly ought to know,
So I plugged through and got my degree
Now I have worked twenty-six years
Laying out sewer mains for the city
For twenty-four hundred a year
Bill Hosford always came in late
And copied my chemistry into his book,
And got me to do his German exercises
He got so many Bumps that he left after two years;
Now he owns half Chicago
And has one of the new buildings named after him;
He ate his cake and he has it, too.
Where do I put in,
I wonder

(Edgerly Blisters, in M.I.T. Pantechnicon)

The New

Weston

Single-Phase and Direct Current, Portable Electrodynamometer Wattmeter, Model 310



An Instrument of Precision guaranteed to have a calibration [illegible] and direct current circuits of any [illegible]

Double [illegible] provided for both current and voltage circuits. [illegible] 100 per cent overload indefinitely without injuring [illegible]

The [illegible] very effectively damped. Indications are independent of temperature and the instrument is shielded from external magnetic fields. The scale, 5¼ inches long, is uniform throughout the entire length, a characteristic of great value. It is hand-calibrated and provided with a mirror, over which the knife-edge pointer travels, and the pointer may easily be adjusted to zero by means of a zero-correcting device.

For complete information regarding Model 310 Wattmeters (illustrated) and Model 329 Portable Polyphase Wattmeters write for Bulletin No. 2002. Other Models in this group are Model 341 A. C. and D. C. Portable Voltmeter, described in Bulletin No. 2004; and Model 370 A. C. and D. C. Portable Ammeter, described in Bulletin No. 2003

Weston Electrical Instrument Co.

69 Weston Ave., Newark, N. J.

Branch Offices [illegible] Co.

THE MENACE OF—?

This is the kind of stuff you hear on the front porch:

"Why, George, how dare you? Now you can just go right home, and never, never speak to me again.

George goes—as far as the steps.

"Let me come back, please. I'll be good—honest I will."

"If you're going to be good, there isn't any reason for coming back."

"Oh, you little angel."

"George, dear, I can't breathe."—Gargoyle.

"How long have they been married?"

"About five years."

"Did she make him a good wife?"

"No, but she made him an awfully good husband." Judge.

50-50

Student (trying to pick her up)—The fellows bet me a dollar, I didn't dare speak to you. You don't mind, do you?

Beautiful Girl—Not at all. Run along now and get your dollar.—The Widow

Mr. Dudds: "Why do you always stand before the mirror while dressing?"

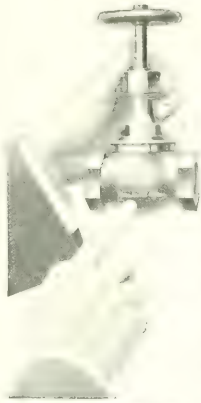
Mrs. Dudds: "To see what is going on of course."—Puck.

THE FRUIT THEREOF

He boasts about his family tree
Does Algy Mutt;
But in his case, it seems to me,
It bore a "nut."

C. S. of M.

Jenkins Bros.' Valves



For longest service and freedom from valve troubles, specify Jenkins Bros. Made in various styles for different conditions of service. Jenkins Bros. Hose Valves for fire protection service are of strong, heavy pattern, and regularly fitted with Jenkins No. 93 Disc. This is a rubber disc of tough flexible composition, suitable for hydraulic pressures up to 250 pounds. Does not stick or corrode.

Jenkins Bros.

Genuine Jenkins Bros. Valves always have trade mark.

New York, Boston, Philadelphia, Chicago, Montreal, London

Tech Student. Seems to me Shakespeare uses awfully hackneyed phrases. Why, I've heard that "to be or not to be" a lot of times.—Yale Record.

"Tommy," cautioned his mother, "be sure to come in at four this afternoon to get your bath before you go to the Jones' to supper."

"But, mother," protested the lad, "I don't need a bath for that. They said it was to be most informal."—Harper's Magazine.

MEMORIES

"Why didn't you get up and give that lady your seat?"

"Well, man, ever since I was a boy it's been me to give a woman with a baby in her hands."—Lehigh Burr.

GIVE THE CALL MORE ROPE.

O. "If the French soldier wore Paris garters they would never be shot."

G. "Advance, friend."

O. "No metal can touch the skin."

G. "Have him shot at sunrise."—Jack-O'Lantern.

Fire-eating Young Man. I was [illegible] carried away by a wave [illegible] the other day.

Girl (eagerly). And what was the song?—Medicine Man.

Fire-eating Artist. "Ah, you will [illegible] have on your face when I have finished you?"

Quick-witted Spectator. "Oh, [illegible] both [illegible] you're [illegible]."—Widow.

STONE & WEBSTER ENGINEERING CORPORATION

CONSTRUCTING ENGINEERS

NEW YORK BOSTON CHICAGO

Reggie—I say, old chap, what kind of a shaving glass must I get?

Ruffie—A microscope, Jeems, a microscope.—Chaparral.

The Humorist (composing)—"And the squirrel couldn't crack the nut—what should he do? Throw it away?"

"Gnaw!"—Tiger.

"Why do they call that kind of sculpture a frieze?"

"Well, if you had to stand out all the year around in that same amount of clothes, you'd understand."—Jack-O'-Lantern.

"Yes, Jones is a prominent member of our fraternity."

"What's his official capacity?"

"Oh, several gallons."—Siren.

"It's a treat to listen to him!"

"What did he say?"

"What'll you have?"—Awgwan.

Ikey—"How much vas dose collars?"

Store Clerk—"Two for a quarter."

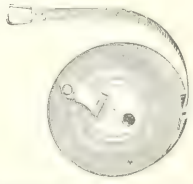
Ikey—"How much for vun?"

Store Clerk—"Fifteen cents."

Ikey—"Giff me de odder vun."—Yale Record.

LUFKIN Measuring Tapes

"Measure up" to to-day's exacting standard of engineering work and stand approved by the good judgment of the engineering world



THE LUFKIN RULE CO.

SAGINAW, MICH., U. S. A.

LONDON, ENGLAND WINDSOR, CAN.

NEW YORK

FANNY FREEMAN JUDGING CHORUS GIRLS — GIVING THEIR LIMBS THE O.O.
EVANS — I HEAR YOU HAD THE MAKINGS OF A GOOD HOCKEY TEAM ANYWAY.
TUTEIN — WE DID, BUT THE MAKINGS WERE ALL.
AT THE MARY CHENEY ROOM — CLEOPAN TAKING HER WEEKLY EXERCISE (GESTHETIC DANCING) THIS IS A LITTLE INSIDE DOPE, BOYS.
ON THE L.I. TRIP DURING MID-YEARS — WAY TUTTLE ALMOST MISSED THE TRAIN IN WASHINGTON.
LAWRENCEVILLE
WHERE BOSTON'S GRIPPEY WEATHER HAS PUT MANY OF US.

"IMPRESSIONS," BY THE NEW CARTOONIST.

EAGLE "MIKADO" PENCIL No. 174

FOR SALE AT YOUR DEALER

5c EACH OR 50c PER DOZEN

MADE IN FIVE GRADES

CONCEDED TO BE THE BEST PENCIL MADE FOR GENERAL USE

EAGLE PENCIL CO. NEW YORK

She tenderly: When did you first know you loved me?

He: When I began to get mad when people said you were brainless and unattractive.—Siren.

AT THE RECEPTION

"Isn't she a little bear?"

"Yes, somebody ought to speak to her about it."—Pelican.

Atlantic Printing Company

Printers and Bookbinders

WE MAKE A SPECIALTY OF PUBLICATION WORK. WE CAST ALL OUR OWN JOB FACES, USING NEW TYPE FOR EACH SET-UP. WHICH INSURES GOOD, SHARP IMPRESSION

179 South Street, Boston, Mass.

'PHONE 4960 OXFORD

THE value of advertising lies not only in the extent of the display, and in the numerical measures of circulation, but also in the manner of the display and the character of the medium by which it is circulated.

This periodical reaches a particular class of people; and a class of particular people. The subjects advertised here are worthy of their publicity. And to secure the desired effectiveness the most modern typography and the best composition are employed. The results are incentive to further solicitation.

Through the medium of The Technology Monthly and Harvard Engineering Journal, graduate engineers of both Technology and Harvard are able to advertise their corporations among other Engineers and Constructionists. Graduate Engineers should desire this kind of publicity for their corporations. They are urged to communicate upon this subject with our Advertising Manager and his staff of Copy Writers.

ARCHITECTS' PLANS

THE Old Colony Trust Company is prepared to make special arrangements with architects, engineers and draughtsmen for the storage of plans, specifications, and all kinds of drawings. We maintain safe deposit vaults at all of our offices, which are fully equipped to take care of this business.

Considering the low cost of this service it seems inadvisable to entrust valuable material of this nature to the ordinary office safe.

Rates and further information upon request.

A SINGLE BANK WITH THREE OFFICES
IN DIFFERENT SECTIONS OF BOSTON

Old Colony Trust Company

17 COURT STREET
52 TEMPLE PLACE 222 BOYLSTON STREET

ATLANTIC PRINTING CO., BOSTON